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GROWING POTATOES WITH TRACTOR POWER

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Nine years ago when the first all-purpose tractor became commercially available the Agricultural Engineering Department at Penn State began a research program pertaining to the production of corn, wheat, hay and potatoes with tractor power. In two years, it was conclusively demonstrated that wheat and hay could be successfully grown and harvested with the tractor and the equipment then available. There was definite evidence however, that some potato equipment adapted to the tractor remained to be developed and one of the remarkable things about this situation is that the tractor purchased nine years ago is still well adapted to potato growing.

The next move was to set about the adaptation of the potato machinery to be operated by mechanical power. These adaptations and improvements have been as follows:

1. The perfection of a spring release tractor plow hitch. This was to protect the plow against breakage where limestone ledges appear. This problem—not serious in many sections—has been solved to the point that very stony land can be plowed with a tractor rapidly and economically. See table I.
2. A two row automatic potato planter has been equipped with coil springs and wooden break-pins to protect the furrow openers from breakage when stone ledges are encountered.
3. The engine was removed from a power sprayer and the power take-off from the tractor used to drive the pump.
4. A weeder was designed and built to attach directly to the tractor drawbar.
5. In stony land the spring tooth cultivator had to be substituted for the so-called release type used on horse cultivators.

6. In order to prevent occasional vine damage by the sprayer wheels, small rods about a foot long were attached at the rear of the vine lifters.

7. The power take-off was applied to the potato digger. This type of drive allows the elevator chain to be operated without running the machine when it becomes clogged.

8. A potato harvester has been designed and built which has for three seasons harvested from 15 to 20 acres successfully.

The procedure adopted in growing the potato crop in these experiments was as follows:

SEEDBED PREPARATION

Potatoes follow clover and timothy on the college farm. The sod is usually plowed in the spring 8 or 9 inches deep. This is followed by the spring tooth harrow. In about 10 days the land is disked with a cover crop disk. A chisel or orchard harrow is run just ahead of the planter.

FERTILIZER

About 10 tons of barnyard manure were applied per acre to the potato field in the fall. When the crop was planted about 850 pounds of 4-10-9 fertilizer were applied.

PLANTING

A two row automatic planter is used. For the most part whole seed weighing $1\frac{1}{4}$ oz. is used. The seed is spaced 10 inches in the row in 34 inch rows. The seed pieces are placed about 3 inches below the soil surface and covered shallow. The machine was adjusted and calibrated for the seed and the quantity of fertilizer before going to the field. This planter will do practically a perfect job of planting if handled properly.

FOLIAGE PROTECTION

About 12 spray applications are applied employing a Bordeaux mixture made up of 8 pounds of copper sulphate and 8 pounds of quicklime to 100 gallons of water. When slaking the lime care was exercised not to use too much water which will "drown" the lime.

Likewise, too little water will cause the lime to "burn". The following spray schedule is followed:

1. The "foundation spray series" begins as early as the rows can be seen. Spraying is continued at intervals of 7 to 10 days for three applications. They preclude infection and repel insects.

2. The second, or "heat series" controls insects and counteracts intense heat. As a rule 2 pounds of extra lime are applied to each 100 gallons of Bordeaux mixture. These sprays are applied from 7 to 8 day intervals.

3. The "blight spray series" is applied from 5 to 8 day intervals depending upon the weather.

The all-purpose tractor has ample power to pull the 200 gallon sprayer and run the pump. Two gallons of spray per row and 250 to 300 pounds pressure are the requirements for potato spraying where 3 nozzles are used per row. Stated another way, 150 gallons of Bordeaux mixture per acre are applied. This requires at least 1 horsepower per row to operate the pump.

An 8 row boom is used and is adjusted up and down so that the nozzles are from 18 to 20 inches from the optimum amount of foliage to be sprayed.

WEEDING AND CULTIVATING

After the crop has been planted and before the rows can be seen, the field is cultivated as deep as possible with the 2 row spring tooth cultivator in front of the drive wheels and the middle section of the weeder attached to the drawbar. This is called "blind cultivation" which loosens the seedbed and kills a crop of young weeds. As early as the rows can be seen the field is weeded.

As a rule the field is cultivated about 4 times during the season. The weeder is run after each rain. In case of no rain the field is weeded at 7 to 10 day intervals until the vines are about a foot high. The weeder is always run in the same direction.

HARVESTING

The harvester has a capacity of about 1000 bushels per day. It requires several men to pick the potatoes from a conveyor. This harvester—not yet being built by a manufacturer—is attached behind a power take-off digger. The final commercial machine should be a digger and harvester combination. One reason for

developing a harvester is due to the fact that about one-third of the labor required to produce a crop of potatoes is involved in picking up the crop off the ground.

YIELD

In 1933 the maximum yield was 436 bushels per acre with an average of 305 bushels for the 15 acre field. While no competitive tests have been conducted, the tractor fields have consistently out-yielded the potato crops on the college farm which have been grown with teams. This is probably due to the fact that the work can be done with the tractor at the time when it pays best.

RECENT MACHINERY DEVELOPMENTS

One of the most recent advancements in potato machinery design is represented by three and four row potato planters. These planters are designed and built for tractor operation. They are being used successfully by the larger commercial potato growers.

Another recent machine is a two row tractor drawn potato digger. (Fig. 1). It does not employ two one-row diggers of conventional design mounted on one axle. It is a new design employing a "saw-tooth" digging blade which is wide enough to dig two rows of potatoes. The chain is as wide as the blade and has increased separating capacity due to the fact that it does not have the gap incident to hooking two ordinary diggers together. The chain is made in a V shape with wood strips in the groove of the V. This is an attempt to cut down bruising by having wood instead of iron come in contact with the potatoes. While this machine is not yet commercially available, it unquestionably has considerable merit.

Another recent engineering advancement is the equipment of tractors and sprayers with pneumatic tires. (Fig. 2). Air tires reduce the rolling resistance of machinery thereby saving in fuel consumption and increasing speed. It may be expected too that air tires will damage potato vines less than steel wheels.

POWER AND LABOR REQUIREMENTS

The following table shows the man hours, tractor hours, fuel and oil required per acre in growing potatoes with an all-purpose tractor:

TABLE I

Typical Power and Labor with Tractor for One Acre of Potatoes (1) (Most of these data are based on 5 years' results on about 15 acres per year)

Operation	Machine	Man-Hours Per Acre*	Tractor- Hours Per Acre	Fuel, Gal. Per Acre**	Oil Gal. See total	Grease lb. See total
Plow	2-bottom, 14-in.	2.15	1.79	3.00		
Spring-tooth harrow	32 teeth, 12½ ft.	0.31	0.27	0.57		
Disk harrow	Covercrop, 5 ft.	0.73	0.64	1.13		
Field Cultivator	Spring-tooth, 7½ ft.	0.50	0.42	0.75		
Plant and Fertilize	2 row, 68 in.	3.20†	1.20	1.20		
Cultivate or cultivate and weed						
four times	2 row, 68 in.	2.60	2.15	3.00		
Weed twice	6-row, 204 in.	0.54	0.33	0.50		
Spray 11 times	8-row, 272 in. (power take-off)	3.52‡	2.50	3.60		
Dig	1-row (power take-off)	2.60	2.20	2.58		
Total for above operations		16.15	11.50	16.33	0.8	0.6

*Includes time going to and from field, servicing tractor, making field adjustments and repairs, etc.

**About ⅔ kerosene and ⅓ gasoline. Mixtures were sometimes used.

†Two men planting and fertilizing.

‡About 0.7 hours additional time needed per acre to prepare spray material.

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FIG. 1. A MODERN TWO-ROW DIGGER IN OPERATION



FIG. 2. TRACTOR AND SPRAYER EQUIPPED WITH PNEUMATIC TIRES

THE MINIMUM WEIGHT OF A PRIME POTATO

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During the course of some recent fertilizer studies with Irish Cobbler potatoes a large number of individual hills were harvested for the purpose of recording, among other things, the number of primes and seconds per hill. In separating the primes and seconds, it was found convenient to make the division on a weight basis. Before the separation into two grades could be made it was necessary to determine the minimum weight of a prime potato or the maximum weight of a second.

These weights could be determined by constructing frequency curves from a large number of individual weights of primes and seconds previously separated with a grader,¹ but this method of separation is believed unsuitable for the present purpose because the effectiveness of the grader depends primarily upon the speed of operation, the rate at which the potatoes are fed, and the uniformity of the openings in the grader belt. These factors may be satisfactorily controlled for ordinary grading purposes, but for the present purpose a more accurate separation was required. Therefore the primes and seconds were separated in the present instance by the use of individual measurements and weights of a large number of tubers (20,405). The data thus used were originally compiled for other purposes and were obtained by F. R. Reid of the Bureau of Chemistry and Soils and the writer in 1928, 1929, and 1930, on crops of Irish Cobblers grown in Aroostook County, Maine. Permission for use of the data was very kindly granted by B. E. Brown of the Bureau of Chemistry and Soils and P. M. Lombard of the Bureau of Plant Industry, U. S. D. A.

In compiling the data for the present purpose, the length, breadth, and thickness for each tuber were scanned and the corresponding weight recorded under primes if at least two measurements were 48mm, ($1\frac{7}{8}$ inches), or more, and recorded under weight of seconds if two or more measurements were less than 48mm. In this way it was possible to make accurate separation of the weights of primes and seconds. The weights thus obtained were arranged in two frequency tables with class intervals of 2 grams.

¹The writer is indebted to Dr. Joseph A. Chacka of the Maine Agricultural Experiment Station for suggesting the use of frequency curves.

Figure I. shows the center portion of the resulting curves drawn to fit the data. The point of intersection, corresponding to 60.5 grams, locates the dividing point between the weights of primes and seconds.

The error attached to this point can be readily determined from the lower portions of the two curves extending each side of the line representing 60.5 grams. The area to the right represents the error contributed by the seconds, that to the left being contributed by the primes. Taken together the two areas represent the entire error attached to the dividing point, 60.5 grams, which was found to be 3.8% of the total number of tubers weighed.

Based on the curves constructed, the minimum weight of a prime potato therefore is 61 grams and the maximum weight of a second is 60 grams. These weights, of course, apply only to the Irish Cobbler variety and more specifically to those grown in Maine. It is highly probable however, that they will be found very nearly correct for all normal Irish Cobbler potatoes, except possibly those of the early crop which are usually lower in starch content and therefore lower in density.

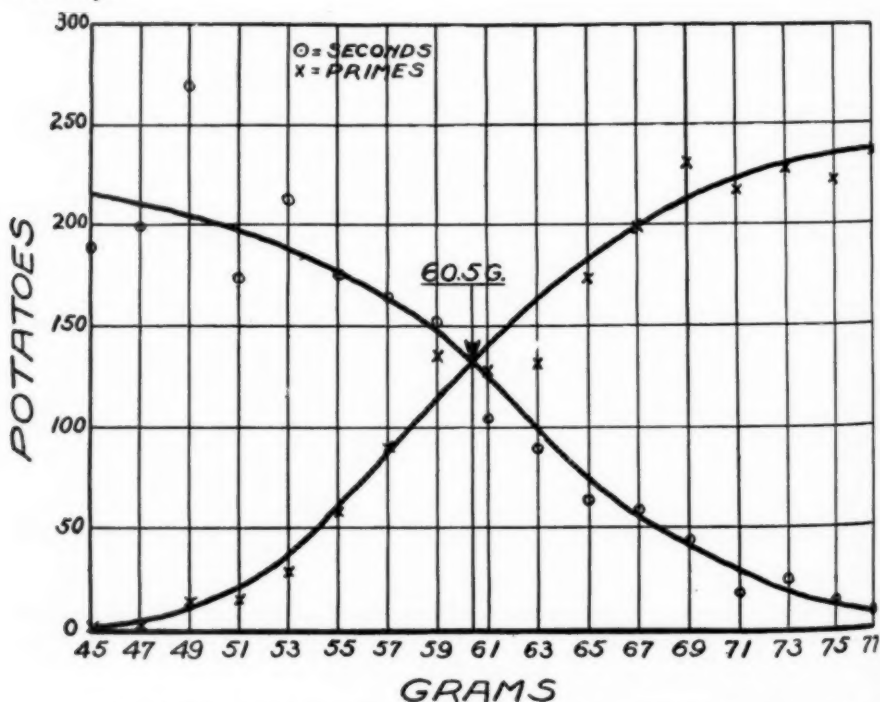


FIGURE I. FREQUENCY CURVES OF PRIMES AND SECONDS BASED ON MEASUREMENTS AND WEIGHTS OF 20,405 TUBERS (IRISH COBBLERS).

SECTIONAL NOTES

CALIFORNIA

While the acreage entered for certification this year is considerably larger than for several years past, still it is quite small in comparison with other states. In 1933, $83\frac{3}{4}$ acres passed final inspection and this season we are expecting that a total of $166\frac{3}{4}$ acres will pass the final inspection although, of course, several things may happen before then. The acreage by varieties now being considered for certification is as follows:

British Queen	50 acres
Burbank	51.75
White Rose	63.0
Bliss Triumph	1.0
Katahdin	1.0
<hr/>	
166.75 acres	

The condition of the crop is very good in most districts. We have some very fine White Rose seed and a considerably larger acreage than in previous seasons. Some difficulty was encountered early in the season because of the decaying of seed pieces, making the stand in some fields rather poor. Late blight has affected certain districts but has been controlled quite satisfactorily. (August 6).—H. W. POULSEN.

The potato crop in the Los Angeles District is of very poor quality and has suffered considerably from heat damage. These potatoes are being used locally and will gradually disappear.

In the Stockton District the early planted potatoes are a very good quality but the yields are running throughout the whole district, 25% less than last year. The potatoes planted intermediate and late have not reached sufficient maturity to warrant an estimated yield but it is quite apparent that if everything is conducive to proper growth, the late crop will at least be 25% less than last year. A close examination of the potatoes under the vines of the late planted potatoes show definitely that the late crop is badly misshapen, seriously affected with growth cracks and has many pitted potatoes. There is no possibility of these defects being overcome. The result on the late planted

potatoes will be considerable shrinkage in merchantable potatoes compared with last year.

About half of the potatoes planted in the Stockton District drop into the category of intermediate and late planted. It is probably safe at the present time to predict that the Stockton District will produce 30 to 40% less potatoes than last year. The general size of the potatoes this year is also conducive evidence of the lessened yield. Last year there were many fields of potatoes in which 15 to 25% of the potatoes weighed as high as two to three pounds. Very seldom a potato is found this year which weighs over a pound and a half. The smaller size this year is the reason that the yields are not going to be so heavy.

The Stockton District is the principal potato producing district of California so the above description is the story for the State.

The situation in the entire west is indicative of considerably less potatoes in the west this year than last year. There is no doubt that yields will be smaller in the state of Colorado. In Idaho many districts that have had plenty of water so far report a poor stand, light set, uneven growth, and very recently a widespread tendency throughout the State for second growth and sprouts to appear on the growing potatoes. The outcome of the crop throughout the state where water has been available, is still in the making. There are many other portions of the state where water has been a limiting factor and there can be little doubt that the yields in these portions will be materially decreased. The situation in Idaho can best be described, at the present time, by the statement that this is not a potato year.

The time of maturity of the crop in the Klamath District of Oregon and the Yakima District of Washington is materially ahead of last year. This factor of quick maturing vines undoubtedly causes lessened yields.

Taken as a whole, the entire region of the United States west of the Rocky Mountains has considerably less potatoes this year than last year. This must have an important bearing on the total production in the United States to the end that the destruction of potatoes in the intermediate states and the fact that the increased production in the early states has already moved off, although they still show up in the government report. All this leads to the probability that as of September 1 this year, there will be no more potatoes in the United States than last year. It must be pointed out that the quantity the late producing areas will produce is still an unknown factor.

Last year was an open fall, potatoes continued growing in many

areas until October with the result that there was a material increase in tonnage during the month of September. The same thing may happen this year and again it may not. If the late areas have an early fall, this will mean a considerably less quantity of potatoes this year after October 1 than we had last year. (August 9).—H. G. ZUCKERMAN.

COLORADO

The situation so far as certified seed is concerned in Colorado is very critical. Our figures on acreage entered cannot be accurate until we have finished inspections, because of numerous withdrawals, and fluctuations as certain conditions in the various sections change or fail to change.

We have in the neighborhood of 3,000 acres entered which is an increase of one-third over last year. The number of growers, however, is practically the same.

The non-irrigated districts will be a total failure unless rain arrives within the next week. Many growers are now contemplating yields which are not in excess of the amount of seed planted. Some of the non-irrigated stock in the higher altitudes is growing quite well, but stands are much poorer than usual because of severe drought at planting time.

On the irrigated land, those farms with exceptional water rights only are able to irrigate, and those who have dug wells and are pumping. All others are out of water. These crops have stopped growing, are wilting very badly, and are about one-half normal size. There can hardly be enough rain between now and digging time to produce anywhere near a normal yield. The condition of the crop at this writing I would estimate about 50 per cent for the state as a whole. (August 9).—C. H. METZGER.

Prospects for a normal potato yield are not bright in the Greeley district. The temperature during the past month has been high with very little rainfall. Irrigation water has been scarce and some growers have been abandoning their potato crops to irrigate sugar beets. Others have given light irrigation to all row crops, depending upon rain later in the season to supply additional moisture.

In some fields where the potatoes have received no irrigation water, the vines are dry and give the appearance of ripening. There are fields, however, in which the vines are small but green. These fields, with a moderate amount of rainfall will produce fair yields.

A trip was made during the past week to the Colorado high altitude Experiment Station at Avon. Potatoes at Avon Station were in excellent condition but the commercial fields viewed on the trip were not particularly promising. (August 14).—W. C. EDMUNDSON.

IDAHO

It is a little early to determine the potato situation in this state other than the information given through the crop estimates. We have had a condition this year which is rather exceptional and have attributed this largely to our lack of cold weather last winter.

We have the poorest average stands of potatoes this year than we have had for many years. The early planted stock was not so bad but the condition became progressively bad up until the latest plantings which were made the latter part of June. Even where seed potatoes had not sprouted badly the seed started rotting from the cut surface almost as soon as planted. Many growers had trouble with the maggots eating the seed pieces, especially on alfalfa lands.

Just how serious this condition is I have not yet determined but will have an opportunity to investigate more fully in the next few weeks.

Owing to the threatened shortage of irrigation water, many of our growers planted a month or more earlier than is the custom and the last week of July we had several days with temperatures above 100° F. I suspect we will have a rather high percentage of No. 2 potatoes inasmuch as the Netted Gem potato is inclined to become misshapen following periods of high temperatures.

I doubt if these factors will affect our yields very materially, although, it is probable that we will not have the crop we would have had with more favorable conditions.

The prospects at present for the seed crop are about the same as for an average year. One district may be cut severely because of lack of moisture but that has been the case for the past two or three years.

We have just started our inspection and even now some of the fields are too small to determine the percentage of disease. One difficulty we have encountered, both in seed and commercial stock this year, is that of poor stand. (August 7).—E. R. BENNETT.

ILLINOIS

Arrivals this morning were very light consisting of only 9 cars from Wisconsin, 13 from Idaho and one from California. Track holdings at Chicago Produce Terminal are only 97 cars. Holdings on all tracks total 116 cars compared with 163 yesterday and 114 cars on hand a week ago.

The market is about a nickel higher. Cobblers from all sections are bringing mostly \$1.35. Triumphs range from \$1.50 on poor stock to \$1.75 on fancy stuff. Idaho Russets are moving slowly at \$1.65 to \$1.70 in a jobbing way.

New Jersey remains unchanged today quoting 90c f. o. b. Shipments from all sections continue light and as a result the market is showing a tendency of working upward. However, buyers everywhere are resisting any advance and are buying on a hand to mouth basis. If shipments do not increase, but continue light as they have been so far this week, the market may go a trifle higher but this will only induce heavier shipments this coming week particularly in Wisconsin and Minnesota and we might have a sharp decline.

The market will remain very sensitive to weather conditions. Rains in the principal shipping sections and cool weather at consuming points will put prices upward whereas a spell of hot weather would do the opposite. Unlike a year ago, growers everywhere seem inclined to sell freely as their crop is ready to dig. (August 15).—ALBERT MILLER & COMPANY.

INDIANA

Good rains have boosted our hopes 100 per cent and it looks now as if our late potatoes are saved. Our heaviest rain in three years 1.17 inches came August 10, showing that we have been dry. There seems to be no leafhopper damage and bugs and blight have never caused us much concern. Our stands run from 50 per cent up to 98 per cent with an average of about 83 per cent. With good weather from now on, I believe we will run about 135 to 140 bushels per acre average, with good growers from 350 to 500 bushels. (August 13).—W. B. WARD.

KENTUCKY

The acreage is just about what it was last year. The weather at planting time was hot and dry, making it necessary for the men to do

their planting between sun-up and not later than 9 in the morning. The stand is well over 90 per cent. Both the Louisville area and that about Lexington, our main certifying districts, have been enjoying rains sufficient enough to give the crops a good start. Our prospects as they appear today are good. (August 13).—JOHN S. GARDNER.

MAINE

The following acreage was entered for certification this year: Green Mountains 8,046; Irish Cobblers 8,705; Spaulding Rose 1,361 and all others 784. We have completed our first inspection with the following results: Green Mountains 6,744; Irish Cobblers 8,429; Spaulding Rose 1,308 and all others 779.

At the present time there is a little late blight showing in some of the fields. This, however, is no indication of what the future holds for us since this is primarily a weather problem. The Cobblers are beginning to show their age. Every indication is that there will be a good yield. The growers are willing to rogue a little blackleg to make excellent seed. The Green Mountain variety is showing that the sources of foundation stock have to be studied very carefully. In other words everyone cannot hope to grow foundation stock, but must deal with those who have good isolation and a good eye for roguing. We expect a better tone to the seed market as a result of the Government crop report given out Friday night. (August 13).—E. L. NEWDICK.

With one of the best stands Maine ever had, the prospects for a crop are excellent. The vine growth is heavy but this is not necessarily indicative of large yields. At the present time the weather conditions are very favorable but some late blight has been developing the last three days. There is also the usual development of black leg. The seed market in the northern states is quite active and the growers here are willing to sell. (August 15).—FRANK W. HUSSEY.

MARYLAND

We are just completing our second field inspection of mountain grown seed. Planting of our second Irish Cobbler crop on the Eastern Shore has just been completed. We have inspected 219.25 acres of potatoes for certification on 73 farms and have disqualified 43.125 acres on 18 farms. A few more fields will probably be disqualified at

the second field inspection, which will make the acreage which is eligible for certification approximately the same as last year.

The condition of the fields is very good and average yields are expected. Virous diseases are not prevalent. Most of the disqualification resulted from the presence of *Fusarium* wilt in amounts greater than the tolerance permitted for certification. Indications are that the amount of second crop Irish Cobbler seed entered for certification will not be any larger and may even be smaller than that entered last year. (August 9).—R. A. JEHLE.

MASSACHUSETTS

The early crop of potatoes is being dug in this section, and the market has been flooded in some cases. Some dealers are offering as low as forty cents a bushel for new potatoes, and some farmers are refusing to sell at this low price.

Dry weather has unfavorably affected both the early and the late potatoes, the latter more than the former. Some heavy infestations of aphids have occurred, and some farmers have sprayed with a nicotine spray. (August 13).—A. B. BEAUMONT.

MICHIGAN

The potato acreage in Michigan this year is about two hundred and seventy thousand compared with two hundred and sixty-five thousand for 1933. The condition of the crop as reported the 1st of July was seventy-four per cent while last year at the same date it was seventy-two, as compared with eighty-five per cent, the average for the past ten years. Extreme heat and drought earlier in the season delayed planting of many fields two weeks or more. We have experienced extreme drought and heat throughout the central and southern counties and the stands in these sections are rather poor, there being many weak and missing hills. In the more northern counties of the Lower Peninsula and especially in the Upper Peninsula, we have had more rainfall and the potatoes are looking better. A trip through several northern counties of the Lower Peninsula this week showed fields to be in a generally good condition. Not much can be said at this time as to possible late crop yields as so much will depend on the rainfall that we get from now on to the close of the season. Yields of early potatoes in southern Michigan have been very disappointing due to light yields of small tubers.

Our certified seed acreage this year is approximately the same as last year with two thousand five hundred and sixty-three acres compared with two thousand two hundred and eighteen for 1933. Approximately two thousand acres are planted to the Russet Rural variety this year. Other varieties include White Rural, Green Mountain, Russet Burbank, Katahdin, and Irish Cobbler. There has been an increase in the Green Mountain this year there being approximately thirty more growers in the Upper Peninsula who are producing about one hundred acres more of certified Green Mountains this year than they did last. Acreages of other varieties remain about the same as last year. We are certifying about eighty-two acres of the Katahdin variety. This is the first season that this variety has been entered for inspection and certification. Approximately thirty-five hundred bushels of the Katahdin were distributed last season pretty well throughout Michigan. We are obtaining records as to yields on many of the lots and should have some ideas as to their adaptation to Michigan conditions. So far, the Katahdin variety seems to be very good, for under extreme heat and drought it will make a fair crop of marketable potatoes, while the Rural varieties under the same conditions often develop tubers of very poor type and small size.

A Potato Field Day is planned for Wednesday, September 12 at the Potato Experiment and Demonstration Farm, Lake City, Michigan. A special feature of the meeting will be a potato machinery exhibit, showing a rather complete line of soil fitting, planting, spraying and harvesting machinery. After a short speaking program at noon, the experimental plots will be inspected. Experiments include date of planting, fertilizer, irrigation, seedling and variety tests. In the afternoon it is also planned to hold a digging demonstration and an irrigation demonstration, using the canvas hose. There are approximately forty-five acres of potatoes planted at Lake City in demonstration and experimental plots. Growers from all over Michigan are planning to attend this meeting. A cordial invitation is extended to out-of-state visitors. (August 7).—H. C. MOORE.

Observation made in the Upper Peninsula July 23 to August 8 showed potatoes to be in excellent condition. Many of the fields of Green Mountain and Rurals had tops completely covering the ground. Last year in this section there were several 400-500 bushel yields and I see no reason why they will not yield fully as high this year if the rainfall is normal for the remainder of the season. The southern section of the state has been hit by drought and prospects are for a shorter

crop this year than last. Many of the fields were planted in dry soil and the stand is very poor.

Potatoes at the Lake City Potato Station, irrigated with the porous hose, are holding their own whereas other fields of potatoes in the locality are drying up.

Dr. F. J. Stevenson of the United States Department of Agriculture is to spend a few days in the State this week inspecting the seedling work, also observing the Katahdin and Chippewa potato varieties grown on a commercial scale. (August 13).—E. J. WHEELER.

MINNESOTA

The season of 1934 bids fair to be a repetition of 1933 in that much needed moisture in developing a crop of potatoes has been lacking. This fact, coupled with a number of excessively hot periods during tuber formation, has had a marked effect on the yield and quality of potatoes in the sand land area particularly. However, the potatoes in this region being grown on peat are doing remarkably well, and the prospects for a good yield on this type of soil are favorable at this time.

In the Red River Valley, stands are below normal in general, although many fields have stands as high as 90% to 96%. The crop in this section of the state has reached a stage where a general rain will make the difference between a failure and a fair yield. So far, what rains have occurred have been scattered and few and far between.

The northeastern part of the state has been favored with considerable precipitation, and at this time the prospects for a good crop of potatoes are very promising.

Six thousand one hundred and sixty-four acres are being inspected for certification, and the indications are that fewer fields will be rejected than heretofore, due to the high-class seed stock planted. Most of the stock being inspected consists of Bliss Triumphs, Irish Cobblers, and Early Ohios. Fifty-four acres of Warba, the new early variety originated by the Minnesota Experiment Station which we feel should have a place on our potato markets, are being inspected for certification.

During the past three or four years, we have been encouraging 4-H Club members who have chosen the growing of potatoes as their project to take an interest in the seed potato certification work. A considerable increase in 4-H certified seed growers has taken place this

year, and although most of these plots are an acre or less in size, we feel that the time spent with these boys is very much worth while. They have been furnished with the best seed stock available, and the first inspection reports indicate that many of these future farmers will be successful with this enterprise.

The second field inspections are now under way and will be completed by the end of August.—A. G. TOLAAS.

MONTANA

We have the following acreage listed at present, including eleven acres of Triumphs rejected on the first inspection because of disease:

Bliss Triumph	193 $\frac{3}{4}$
Netted Gem	292 $\frac{3}{4}$
Irish Cobbler	38 $\frac{3}{4}$
Katahdin	10
White Rose	40

The potato crop as a whole is about average, although some fields are a little backward due to seasonal conditions and other fields are showing a rather thin stand. Poor stands in a few cases can be attributed to the work of maggots on the seed pieces early in the spring, but for the most part the poor stands were caused by the drought that followed immediately after planting. Irrigated fields, where the soil was well prepared and then firmed about the seed pieces at planting time, generally show a good stand, good top vines, and average good set. (August 10).—E. E. ISAAC.

NEBRASKA

The writer has recently returned from a trip through western North and South Dakota, and conditions relative to moisture are extremely severe. Practically no moisture has been had since planting time, which was about June 15. Occasional local showers have relieved the situation in those vicinities where the relief was received. The relief was extremely temporary, however, because of the prevailing hot and dry winds over the entire territory.

Our potato crop acreage was increased about 15% over last year, at the time of planting, but this has more than been offset by acreage losses due to insect ravages, drought, and poor stands. The acreage entered for certification totaled 10,000, and with acreage still remaining, which has not been withdrawn, will be in the neighborhood of

9,000, with a condition approximately 60% of normal. In the last two days, rains have fallen over most of the territory, as far as we are able to determine. At this point we received our first rain of any consequence since the middle of June. This rain totaled .52 inches. Fields of potatoes which are ordinarily six to ten inches high, at this time, are just barely coming out the ground, and we certainly cannot hope for anything like normal stand because a good many of the seed pieces have already rotted.

This is a very poor picture to paint with regard to the potato situation in western Nebraska. Of course, it is very difficult to say what we can expect, because the possibilities of recovery of a potato crop are great, and even though it is extremely late, we may get a normal yield before the end of the season. There are a good many fields, however, where nothing will be harvested, since they have been abandoned and other crops have been planted. (August 10).—MARX KOEHNKE.

The prolonged drought accompanied by more than thirty days with maximum temperatures over 100 degrees, and with many days having temperatures up to 105 degrees, resulted in a practically complete failure of the early potatoes except where irrigation was available. Under irrigation the crop has been fair and the vines have stood up surprisingly well. There will be a great shortage of locally grown potatoes in the portion of the state which customarily takes care of its own needs until late autumn.

In the western part of the state where the late commercial crop is grown, soil conditions were excellent when the crop was planted in June. Although the weather was very hot in many localities, there were a few scattered showers which kept the plants in a reasonably good condition. However, many of the fields are still very slow and irregular. Rains during the last two days will probably carry the dry land fields for another brief period. With a few rains between now and the middle of September a satisfactory dry land crop may still be produced.

Unusual pests made their appearance this year. The blister beetles appeared in great numbers and did considerable damage to the plants just shortly after they emerged through the soil. Sodium fluosilicate dust was found to be reasonably satisfactory. With the drying up of native grass lands and many of the crop failures, the potato fields were unusually attractive to Jack rabbits and in many instances a great deal of damage resulted from their activities. Where the area of potatoes was rather small in proportion to the number of Jack

rabbits, the latter not only ate the leaves and stems above ground but in many instances followed the stem under ground even to the extent of digging out the old seed pieces. Strychnine mixed with salt was used very effectively as a poison to kill off these predatory Jack rabbits.

In the irrigated regions in the western part of the state irrigation water has been available on some of the projects for only a few days with several weeks interval between. This, however, seems not to have brought about quite so acute a situation as was feared because most of that region enjoyed a few effective showers that were well distributed. Although the plants did not make so much growth as usual they still appeared quite healthy and were generally not stunted to a serious extent. (August 11).—H. O. WERNER.

NEW HAMPSHIRE

The fields entered for certification at the time of the first inspection were in very good condition. The stand was usually good, though in a few instances when the seed had been planted in too dry soil there were a number of missing hills and the fields looked ragged. Ninety-one acres of Green Mountains and three acres of Irish Cobblers passed the first inspection. (August 3).—O. BUTLER.

NEW JERSEY

The Freehold and Hightstown offices of the Central Sales Company have worked with the growers' committee in disposing of the Central Jersey crop. In the first two weeks of operation the two offices maintained the f. o. b. price at \$1.00. The movement during this period was not heavy but it was clearly demonstrated that price cutting can be avoided by this type of organization. It is generally agreed that with the dealers acting independently the price would not have been higher than 65 cents at the end of two weeks. New Jersey still has from 50 to 60 per cent of the crop to harvest. The growers are hopeful that prices will improve later and consequently are harvesting the crop slowly. Yields are smaller than anticipated in the early season but the quality is excellent. (August 25).—WILLIAM H. MARTIN.

NEW YORK

During the first two weeks in August Dr. Hardenburg and the writer visited about 150 table stock fields in southwestern New York.

These fields were selected at random and should give a fair picture of practices and conditions prevailing in the average field.

The observations made indicate:

1. Not over 20 per cent of the fields in this area are free from mixture.
2. Seed stock is usually kept five years or more and sometimes as long as 30 years.
3. Leaf roll is conspicuous by its scarcity.
4. Yellow dwarf commonly runs from 1 to 10 per cent averaging about 3 per cent.
5. Missing hills run high this year,—are generally attributed to the dry weather. Some of them may be due to severe yellow dwarf.
6. Many fields of the Rural type have been planted very late, some as late as the middle of July.
7. Drought conditions prevail in this part of the State but few fields have suffered so severely as yet that they cannot produce a large crop if rains should come.

The acreage entered for certification appears to be about 5 per cent less than last year according to a preliminary estimate. Virous diseases seem to be about as prevalent as usual. (August 10).—K. H. FERNOW.

The August first potato crop estimates for New York is 23,690,000 bushels compared to 24,720,000 as of July first. This reduction is quite in line with the shrinkage in estimate for the U. S. crop since a month ago and reflects the drought conditions throughout most of the country.

Since August first, Dr. Karl Fernow and the writer have inspected a random sample of 176 fields in seven counties of western New York to determine quality of seed planted, varietal mixture, stand of plants, cultural practices and growth conditions. No section of this region has been favored with sufficient rains during the critical growth period of blossoming and tuber setting. Although it is impossible to say what a normal stand of plants is, at this time the average stand shows over 11 per cent of missing hills. Many growers attribute this to the rotting of cut seed planted in hot dry soil during May. An abnormally large number of fields were planted after the middle of June as growers postponed planting until after the rain came. Yields in these fields will depend on length of season and weather from now on. Very few fields have been either sprayed or dusted as most growers do not feel finan-

cially able. Flea beetle injury is very general and hopper burn is showing in the earlier planted fields.

Local showers have benefited most sections of western New York since August first with the result that the plants are in fair growing condition now. Sections still needing rain are northern Allegany, southern Wyoming, southern Erie, and most of Ontario County. Altogether it might seem that the main crop in New York will be even smaller than the crop of 1933. Aphis injury accompanying the extreme heat of July combined to permanently reduce the Green Mountain crop on Long Island. The early crop here was good but extremely low prices have discouraged growers from digging. It is doubtful that the early crop will return any profit. The only hope remaining is based on the fact that a short crop of late varieties may result in better prices during the winter marketing season. (August 13).—E. V. HARDENBURG.

OREGON

In this state, a large share of our potato certification work is done in western Oregon, where potatoes are normally planted from the last week in June to the middle of July. Requests, therefore, from you and from the U. S. Department of Agriculture as to our certified potato yield are always premature. As a matter of fact, our first inspections have not yet been made, and will not be made for a month yet because the potatoes now are only emerging from the ground.

I anticipate that we will have a reduction from the acreage passed last year, which amounted to about 1,300 acres. I judge that this year we will have about a thousand acres, consisting probably of around 500 acres of Netted Gems, 400 acres of Burbanks, and about 100 acres of such miscellaneous varieties as Earliest-of-All, Irish Cobbler, Garnet Chili, Early Rose, etc. The disastrous wind-up in last year's marketing season rather discouraged some growers from entering their potatoes for certified seed this year. They felt that they had spent considerable money in fees, extra work of roguing, etc., and did not get much out of it.

The commercial crop in this state looks pretty good now. It is pretty largely concentrated in Klamath county, which last year shipped well over 3,000 cars, and according to present indications the county will ship as many potatoes again this year. The balance of the state, however, will probably not have as many potatoes as last year, so that

total shipments from this date will probably be slightly under last year's crop. (August 10).—E. R. JACKMAN.

OHIO

Light rains in June were followed by the hottest July on record. The Columbus Station reports an average temperature of 80.2 degrees. There were 16 days when the temperature was 90° or more and 6 of 100° or more. The eastern part of the state has had more rain than the western part; and the potatoes therefore, are in better condition.

Cobblers are now being dug. Some crops in the eastern part of the state are yielding 250 to 275 bushels while few in the western section will yield over 100 bushels except on the muck. A few watered crops will make around 400 bushels. The tubers in fields in western Ohio that were planted rather late are badly misshapen and show sprouts.

The late crop planted in May shows good stands, while June plantings generally show poor ones. The later plantings have withstood the extreme heat better than the early ones. The lower leaves on the larger plants are burned quite high up on the stalk. The extreme heat has delayed setting on the late crop and it has been our observation that when setting is delayed, the plants set light and consequently reduce the yields.

Thirty-four acres of Russet Rurals are entered by three growers for certification. They were planted June 15th to 20th. The first field inspection has been completed. The stands and growths are excellent and only a trace of disease is present, a few plants showing fusarium. (August 11).—E. B. TUSSING.

PENNSYLVANIA

The weather in July was extremely hot and hard on early planted fields. Moisture has been fairly adequate save in a few northwestern counties. Much of the state had general rains around August 12 which relieved droughty conditions in many sections; and in some cases started second growth.

The early crop is practically dead. Some digging has been started but many are waiting for an expected rise in price. Cobblers which were well grown and sprayed are yielding 200 bushels or better to the acre. Many fields set rather lightly due to dry periods; consequently, size in good fields is above average.

The late crop has set pretty well and, aside from some poor stands, looks promising. Fleas, hoppers and tarnished plant bugs are very bad; in unsprayed fields, leaves are tip burning badly. (August 15).—J. B. R. DICKEY.

SOUTH DAKOTA

The size of the potato crop depends very much on climatic conditions which we may encounter within the next seven or ten days. Up to the present time our potatoes have been passing through the drought in fairly good condition. They are now, however, very badly in need of moisture. Unless we get relief quite soon I am very much afraid that the crop will be very limited. Unless relief is forthcoming soon only a very small amount of potatoes will be shipped out of the state.

With regard to the condition of our certified potatoes, I may say that due to climatic conditions and ravages from insects we have started out this year with a new source of seed from North Dakota. This source of seed has had a most excellent record, and is giving a good account of itself this year, at least insofar as freedom from disease goes. The size of the crop depends of course on the same condition as mentioned above.

The acreage of certified potatoes is very small this year, only 160 acres. The reason for this small acreage is due to the fact that we discharged our former strain and that since we had to pay a rather high price for the new stock, farmers did not feel inclined to go into it very heavily. Another reason for the low acreage is that climatic conditions during the early part of the season were not at all favorable to potato production. (August 6).—K. H. KLAGES.

EASTERN SHORE OF VIRGINIA

With the exception of a few cars held in storage, the Eastern Shore of Virginia and the Eastern Shore of Maryland have completed the shipment of their 1934 white potato crop.

The acreage of white potatoes in Virginia, as a whole, is reported by the United States Department of Agriculture to have been increased 15% over the 1933 acreage.

The Eastern Shore shipments, as reported from the same source, were 7,641 cars in 1933, with approximately 13,000 cars in 1934.

This increase in volume in Virginia, with a very heavy increase

of high yielding acreage in North Carolina, an increase in acreage and a good crop in the commercial districts whose shipping season follows immediately after the Eastern Shore of Virginia district, led to oversupply and a price situation which is very painful to bring to mind.

The average selling price of Eastern Shore potatoes, as determined from those who reported to the Department of Agriculture, was \$1.46 per barrel and 91c per bag for the season. The price situation was brought about not only by excess tonnage on the Eastern Shore and in competing areas, but also by the poor keeping quality of the stock. Many potatoes were injured in the ground or by the intense heat after the potatoes were dug, so that decay season has ended with a serious loss to those who produced white potatoes, leaving in its wake a bad financial condition.

The effect of the AAA Marketing Agreement set up this year for the districts including the northern part of North Carolina, the early producing sections of Virginia and the Eastern Shore of Maryland is worthy of considerable thought. Naturally, the outcome is difficult to evaluate and is very disappointing to many people who felt the price situation was fully susceptible to local manipulation through control of local shipments under the pro-ration system. They speculate now as to what influences, local or otherwise, are to blame for lack of proper price response to the operation of the local agreement. Generally speaking, too many people feel that the success of such a plan is more dependent on local control than would seem to be the case.

The marketing agreement went into effect, in a practical way, on July 16, at which time the price of potatoes had dropped to \$1.25 per barrel, f. o. b. Eastern Shore of Virginia shipping points. At this time potatoes had already been produced (and marketed) in excess of market demands not only in Virginia but, also, elsewhere. North Carolina had shipped an excessive amount of potatoes, many of which were warehoused but had not been re-sold or distributed. Furthermore, New Jersey, Long Island and other commercial northern points had a large crop of potatoes which were ready to move. To add to this supply was the stock grown in home lots and small acreages operated by farmers and truckers locally within our large marketing area, and these were being marketed and served to curtail demand for our stock.

The hopeless conditions which prevailed, all of them originating before the marketing agreement went into effect and many of them

operating outside the territorial limits under agreement, created a situation which could not be adjusted satisfactorily by withholding for a restricted period a part of the tonnage available for market in the areas under agreement.

There is no disposition to indicate that the agreement, even in its incomplete and restricted application, served no useful purpose and offers no promise of future usefulness. Furthermore, nothing else is offered to relieve the almost untenable position in which the industry finds itself.

Under the conditions which prevailed, the agreement at least served as a trial balloon preliminary to the application of a more complete agreement in 1935.

A dispassionate view of the price response, brought about by temporarily withholding a portion of the potatoes available for shipment in a relatively restricted area, leads one to believe that the potato is not susceptible to a satisfactory increase in sales price by such means. The potato is so widely grown, its competing areas are so overlapping in many factors influencing production and marketing, and each is so susceptible to influence from conditions within its competing areas, that a satisfactory control plan must be widened beyond the mere pro-rating of shipments.

In fact, it would seem that a relatively close balance between production and demand must be brought about over a broad area of competing districts if the marketing agreement, through a pro-rating system, functions successfully. In other words, the need of a marketing agreement, as generally understood, must be greatly minimized through widespread production control before the agreement can operate to advantage. Therefore, to be of real worth, a marketing agreement must widen its scope to the point that the quantity of potatoes which may be shipped—not only from a single production area but also from its competitive areas—must be controlled, and this in its final determination apparently involves what may be shipped (Virtually what can be profitably grown) by the individual farmer.

The above thought does not excuse or minimize the many faults and weaknesses that are bound to occur under the competitive influences that are a dominant part of the potato industry, not only as they apply between competitive areas but, also, their effect on increased production, disorganized distribution and price cutting within a local production area and the resultant opportunity for price manipulation by big purchasing factors. However, with these competitive influences, or with industrial control which would eliminate the most competitive

features, and with or without a marketing agreement, this broad aspect of production to meet a fair priced demand is a prerequisite to the successful operation of the potato industry and a prerequisite to any other plan that purports to benefit the condition of the industry.

The ill effects of the members of the potato industry competing with one another can only be solved when the individual producers locally greatly unify the control of their industry. This situation, if overcome in local districts, will be helpful but until the same control widens and becomes effective between competing districts, the full potential possibilities for profitable prices can not be realized.

The marketing agreement will probably go into effect over a rather wide area next year, beginning early enough in the season to utilize all possibilities for its success. Generally speaking, the producers and shippers in this area seem to be earnestly in accord in giving it full support. Other matters which have been discussed above, leading to better prices through less competitive methods and greater control of distribution by the industry, have not met with sufficient response by the growers to give promise of success in the immediate future. (August 11).—G. S. RALSTON.

VERMONT

Six hundred and fifty-one acres have been entered for certification this year. Of these 512 are planted with Green Mountains, 130 with the Irish Cobbler, 7 with Katahdins and $2\frac{1}{2}$ with other varieties.

Conditions have been difficult for determination of Mosaic and some fields have suffered as the result of drought but on the whole there has been a good stand and in most cases a good set. The crop got off to a good start and except in the spots where there have been few if any showers, the yield will be above the average. There have been fewer than usual of leafhoppers but the flea beetle is uncommonly plentiful in many fields. Other insects have been about as usual. (August 14).—H. L. BAILEY.

WASHINGTON

We have an increase of applications for certified seed potatoes during the present season, approximating 25 per cent. The general condition of the fields up to date is normal, and this means that our tonnage of seed potatoes for the present season will be close to 25 per cent more than last season. While the Netted Gems or Russet

Burbanks still occupy considerably more acreage than all other varieties together, there has been considerable increase in the White Rose and Irish Cobbler varieties. (August 6).—CHARLES D. GAINES.

WISCONSIN

Since submitting the last report several areas in the upper half of the state have been injured by heat and drought. In these sections crop prospects that were unusually favorable on June 15th are considerably less favorable on August 1st. A change to favorable weather conditions during the forepart of August will, however, assure Wisconsin of a favorable crop of certified seed for the 1934 season. The certified seed will be divided mainly among the Rural New Yorker, the Russet Rural, Triumph, Irish Cobbler and Green Mountain varieties. At the present date there is some change toward favorable weather conditions. Several areas are assured of a fair to good crop of early potatoes. (August 7).—J. S. MILWARD.

WYOMING

Our records show the following acreages of Wyoming certified seed potatoes:

Bliss Triumphs	5,450
Irish Cobblers	256½
Early Ohios	13½
Red McClure	1

The inspectors are now inspecting these fields. It is impossible to give an estimate of the acreage after rejections are made. The acreage which has been inspected to date gives promise of a yield somewhat below normal. All the rains upon the dry lands have been small, local showers. The rains coming within the next month will largely determine the yield of the certified seed potatoes.

The acreage in Wyoming is somewhat larger this year than last, however, the prospects for fair yields of seed are no better than at this same time last year. It will be recalled, that late season rains last year gave good yields of good quality seed. This may occur again this year. (August 3).—GLEN HARTMAN.

CANADA

Intentions to plant as published by the Dominion Bureau of Statistics indicate an increase of 2% as compared with the 1933 plots acreage. Detailed figures by provinces follow:

Province	1933 Acreage	% of 1933	Intended Acreage 1934
Prince Edward Island	37,600	103	39,000
Nova Scotia	20,500	102	21,000
New Brunswick	46,900	103	48,000
Quebec	133,100	104	138,000
Ontario	157,500	102	161,000
Manitoba	36,400	101	36,800
Saskatchewan	45,700	99	45,000
Alberta	32,000	101	32,300
British Columbia	18,000	108	19,000
CANADA	527,700	102	540,100

A total of 6,725 growers throughout Canada have applied for inspection this year, as compared with 5,297 in 1933. Approximately 27,500 acres are listed for field inspection with a view to certification, an increase of about 3,000 acres over last year's acreage. The increase is practically all in Irish Cobblers. There is a decline of a few hundred acres in Green Mountains, but this is balanced by an increase to the same amount in Bliss Triumphs. It is my opinion that the total crop will not exceed that of last year to any material extent.—

JOHN TUCKER.

THE PRICE SITUATION

The following report on potatoes was released on August 15 by the Bureau of Agricultural Economics of the United States Department of Agriculture.

Potato prices declined seasonally during the first half of July but, owing to a sharp drop in weekly car-lot shipments and unfavorable late-crop conditions, prices recovered sharply during the first week

of August. Most of the gains, however, were made in western markets, where nearby supplies are scarce at this season. Late-crop shipments are expected to increase seasonally, and the immediate trend of prices is expected to be slightly downward unless the late crop suffers further damage from the drought and heat.

The August 1 forecast of the total United States potato crop was 327,000,000 bushels, or only 2 per cent above the relatively short crop of 1933 and 10 per cent below the 1927-1931 average production. The Early and Intermediate States are harvesting crops 8,500,000 and 4,600,000 bushels respectively larger than a year ago, but the crop in the 30 Late States is now expected to be about 6,300,000 bushels smaller than in 1933. All of the decrease in the late crop occurs in the 10 Western Surplus States, for which the forecast is more than 13,000,000 bushels below the estimate for last year. The three Eastern and five Central Surplus States have crops larger than a year ago, while the 12 other Late States have prospects for a crop about the same as in 1933. Showers falling since August 1 in many of the important Late States are expected to increase the crop prospects in these areas and add to the total supply of late potatoes.

Supplies of potatoes for immediate shipment are shifting from the Virginia-Maryland area to New Jersey, Long Island, Idaho, and other early crops of the Northern Late States. The total car-lot movement has decreased from more than 5,000 cars per week to only slightly more than 2,000. Car-lot shipments of the 1934 crop totaled 59,000 cars to August 4, compared with 44,000 cars to August 5, 1933.

Potato prices at New York declined seasonally during most of July, from \$1.44 to 93 cents per 100-pound sack (street sales), but recovered to 95 cents during the first week of August. During the corresponding week a year ago they averaged \$2.38. At Chicago the decline during July was from \$1.59 to \$1.17 per 100-pound sack, but there was a sharp recovery to \$1.40, which compares with \$2.95 a year ago. The only shipping point prices available at this time are those for New Jersey, which are quoted at \$1.00 per 100-pound sack.

The United States farm price averaged 66.9 cents per bushel on July 15, compared with 64.4 cents on June 15, 97.9 cents on July 15, 1933, and 81.5 cents the July average for 1910 to 1914.

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ACREAGE REDUCTION NOT A CURE-ALL

In most discussions of the potato growers' ills the prevailing idea appears to be that the obvious and only remedy is reduction in total production. Where production has extended beyond normal requirements a permanent adjustment is necessary. Before attempting anything of this kind, however, we must first be certain that all our ills are traceable to excessive production.

During the week of August 13, this year, U. S. No. 1 Cobblers sold for 85 to 95 cents in Philadelphia. In this same period last year the price was \$2.00 to \$2.15 a hundred. On August 1 total production was estimated to be but little larger than last year. It is true that certain of the intermediate states produced more potatoes this year than last but most of these have been disposed of. In the late producing states the crop is not greatly in excess of last year. Can we conclude from this that excess production is the only factor responsible for present low prices?

Let us assume that we attempt to eliminate over-production next year by a general reduction in acreage. Who is to decide the extent of the reduction necessary? Even with a very considerable cut in acreage, favorable weather conditions together with the elimination of marginal fields and the more general adoption of improved cultural methods would result in much larger average yields with little or no reduction in total production. On the other hand, unfavorable weather conditions in the larger potato growing areas would result in a possible crop shortage and the consumer would suffer.

A crop surplus must be avoided if the producer is to make a living wage. Are we safe in assuming, however, that all our difficulties are the result of over-production? Is it possible that other factors may be responsible for the prevailing low prices? Can potato consumption be increased? Can better methods of marketing the crop be devised? Can the so-called special sales of potatoes be restricted? These and other points need to be carefully investigated before we conclude that over-production is our only difficulty.